

ON THE PERIODS OF CERTAIN METEORIC RINGS.

By DANIEL KIRKWOOD.

I. THE METEORS OF APRIL 20TH.

In the *Astronomische Nachrichten*, No. 1632, Dr. Weiss called attention to the fact that the orbit of the first comet of 1861 very nearly intersects that of the earth, in longitude 210° ; the point passed by the latter at the epoch of the April meteoric shower. A relation between the meteors and the comet, similar to that recently detected between the November meteors and the comet of 1866, was thus suggested as probable. Is this hypothesis in harmony with facts? and if not, are our present data sufficient for determining with any reasonable probability, the true period of the April meteors?

DATES OF THE APRIL SHOWER.—Professor Newton selects the following from Quetelet's Catalogue as belonging to this period :*

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|----|------------|----|---------------------------|
| 1. | B. C. 687, | 4. | A. D. 1093, '4 '5, and '6 |
| 2. | “ 15, | 5. | “ 1122, '3 |
| 3. | A. D. 582, | 6. | “ 1803, |

PERIOD OF THE FIRST COMET OF 1861.—The elements of this body were computed by Oppolzer, who assigned it a period of 415 y.4. Now while it is true that the interval from B. C. 687 to A. D. 1803, is very nearly equal to 6 periods of 415 years, the slightest examination will show that this period does not harmonise with *any of the intermediate dates*. This fact, then, without further discussion, seems fatal to the hypothesis that the period of the meteors is nearly equal to that of the comet.

What is the probable period of the ring?—The showers of 1093—6 and 1122—3 at once suggest a period of from 26 to 30 years. The nodal passage of the densest portion of the ring at the former epoch may be placed any where between 1093 and 1096, and that of the latter, in either 1122 or 1123. The entire interval from B. C. 687 to A. D. 1803 is 2490 years, or 88 periods of 28 y.295 each; and the known dates are all satisfied by the following scheme :

B. C.	687 to B. C. 15....	672.000 years=24	periods of 18,000y each.
“	15 to A. D. 582....	597.000 “ = 21	“ 28.429 “
A. D.	582 to “1093.714...511.714	“ = 18	“ 28.429 “
“	1093.714 to “1122.143...28.429	“ = 1	“ 28.429 “
“	1122.143 to 1803...680.857	“ = 24	“ 28.369 “

These coincidences indicate a period of about $28\frac{1}{3}$ years, corresponding to an ellipse whose major axis is 18.59. Hence the distance of the aphe- lion is very nearly equal to the mean distance of Uranus. It will also be observed that the time of revolution, which seems to have been somewhat lengthened about the Christian era, was previously one-third of the period of Uranus.

II. THE METEORS OF DECEMBER 11TH—13TH.

In the catalogue of Quetelet we find the four following extraordinary displays which belong undoubtedly to this period. Observations made in

*Silliman's Journal for July, 1863.

† Herrick assigned a value of 27 years. See Silliman's Journal for April, 1841, p. 365.

England, 1862, indicate also a more than ordinary number of meteors at the December epoch in that year.

1. A. C. 901. "The whole hemisphere was filled with those meteors called falling stars, the ninth of Dhu'l-hajja, (288th year of the Hegira) from midnight till morning, to the great surprise of the beholders, in Egypt."—*Modern part of the Universal History*, 8vo. Vol. 2, p. 281. Lond. 1780. The date of this phenomenon corresponds to the December epoch, A. D. 901.

2. 930. "Averse remarquable d'étoiles filantes en Chine."

3. 1571. "On vit à Zurich 'du feu tomber du ciel'".

4. 1830, 1833, and 1836. The maximum seems to have occurred in 1833, when as many as ten meteors were seen simultaneously. "Dans la nuit du 11 au 12 décembre, on vit, à Parme une grande quantité d'étoiles filantes de différentes grandeurs, qui se dirigeaient presque toutes avec une grande vitesse vers le SSE. A 10 heures et $\frac{1}{4}$, entre les seules constellations du Bélier et du Taureau, on en compta environ une dizaine."

5. (Doubtful.) 1861, 1862, and 1863. Maximum probably in 1862. The meteors at this return were far from being comparable in numbers with the ancient displays. The shower, however, was distinctly observed. R. P. Grey, Esq., of Manchester, England, says the period for December 10th—12th was, in 1862, "exceedingly well defined."*

These dates indicate a period of about $29\frac{1}{3}$ years. Thus :

901 to 930. 1 period of 29,000 years.

930 to 1571. 22 periods of 29,136 years.

1571 to 1833. 9 periods of 29,111 years.

1833 to 1862. 1 period of 29,000 years.

III. THE METEORS OF OCTOBER 15TH—21ST.

The showers of the following years (see Quetelet's Catalogue) belong to this epoch :

1. 288. "Apparition en Chine."

2. 1436 and 1439. In each year a remarkable apparition was observed in China.

3. 1743. (Quoted from Herrick, in Silliman's Journal for April, 1841.) "A clear night, great shooting of stars between 9 and 10 o'clock, all shot from S. W. to N. E. [Qu. N. E. to S. W. ?] One like a comet in the meridian very large, and like fire, with a long broad train after it, which lasted several minutes; after that was a train like a row of thick small stars for twenty minutes together, which dipt N."

4. 1798. "Brandès marque, à Goettingue, un grand nombre d'étoiles filantes dans les observations simultanées qu' il fait avec Benzenberg."

These dates indicate a period of about $27\frac{1}{3}$ years :

288 to 1439. 42 periods of 27,405 years each.

1439 to 1743. 11 " 27,636 "

1743 to 1798. 2 " 27,500 "

If these periods are correct, it is a remarkable coincidence that the aphe lion distances of the meteoric rings of April 18th—20th, October 15th—21st, November 14th, and December 11th—13th, as well as those of the comets 1863 I, and 1867 I, are all nearly equal to the mean distance of Uranus.

*Silliman's Journal for May, 1863, p. 461.